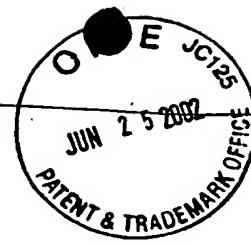


SEQUENCE LISTING



<110> Henson, Cynthia A.
Muslin, Elizabeth H.
Clark, Suzanne E.

<120> Modified barley alpha-glucosidase

<130> 960296.97486

<140> 10/043,418

<141> 2002-01-10

<150> 60/260,787

<151> 2001-01-10

<160> 7

<170> PatentIn Ver. 2.1

<210> 1

<211> 877

<212> PRT

<213> Barley

<400> 1

Met Ala Thr Val Gly Val Leu Leu Leu Cys Leu Cys Leu Cys Leu Phe
1 5 10 15

Ala Pro Arg Leu Cys Ser Ser Lys Glu Glu Gly Pro Leu Ala Ala Arg
20 25 30

Thr Val Leu Ala Val Ala Val Thr Met Glu Gly Ala Leu Arg Ala Glu
35 40 45

Ala Ala Thr Gly Gly Arg Ser Ser Thr Gly Asp Val Gln Arg Leu Ala
50 55 60

Val Tyr Ala Ser Leu Glu Thr Asp Ser Arg Leu Arg Val Arg Ile Thr
65 70 75 80

Asp Ala Asp His Pro Arg Trp Glu Val Pro Gln Asp Ile Ile Pro Arg
85 90 95

Pro Ala Pro Gly Asp Val Leu His Asp Ala Pro Pro Ala Ser Ser Ala
100 105 110

Pro Leu Gln Gly Arg Val Leu Ser Pro Ala Gly Ser Asp Leu Val Leu

115

120

125

Thr Val His Ala Ser Pro Phe Arg Phe Thr Val Ser Arg Arg Ser Thr
 130 135 140

Gly Asp Thr Leu Phe Asp Thr Ala Pro Gly Leu Val Phe Arg Asp Lys
 145 150 155 160

Tyr Leu Glu Val Thr Ser Ala Leu Pro Ala Gly Arg Ala Ser Leu Tyr
 165 170 175

Gly Leu Gly Glu His Thr Lys Ser Ser Phe Arg Leu Arg His Asn Asp
 180 185 190

Ser Phe Thr Leu Trp Asn Ala Asp Ile Gly Ala Ser Tyr Val Asp Val
 195 200 205

Asn Leu Tyr Gly Ser His Pro Phe Tyr Met Asp Val Arg Ala Pro Gly
 210 215 220

Thr Ala His Gly Val Leu Leu Ser Ser Asn Gly Met Asp Val Leu
 225 230 235 240

Al Tyr Gly Ser Tyr Val Thr Tyr Lys Val Ile Gly Gly Val Leu Asp
 245 250 255

Phe Tyr Phe Phe Ala Gly Pro Asn Pro Leu Ala Val Val Asp Gln Tyr
 260 265 270

Thr Gln Leu Ile Ala Arg Pro Ala Pro Met Pro Tyr Trp Ser Phe Gly
 275 280 285

Phe His Gln Cys Arg Tyr Gly Tyr Leu Asn Val Ser Asp Leu Glu Arg
 290 295 300

Val Val Ala Arg Tyr Ala Lys Ala Arg Ile Pro Leu Glu Val Met Trp
 305 310 315 320

Thr Asp Ile Asp Tyr Met Asp Gly Phe Lys Asp Phe Thr Leu Asp Arg
 325 330 335

Val Asn Phe Thr Ala Ala Glu Leu Arg Pro Phe Val Asp Arg Leu His
 340 345 350

Arg Asn Ala Gln Lys Tyr Val Leu Ile Leu Asp Pro Gly Ile Arg Val
 355 360 365

Asp Pro Ile Asp Ala Thr Tyr Gly Thr Phe Val Arg Gly Met Gln Gln

370

375

380

Asp Ile Phe Leu Lys Arg Asn Gly Thr Asn Phe Val Gly Asn Val Trp
 385 390 395 400

Pro Gly Asp Val Tyr Phe Pro Asp Phe Met His Pro Ala Ala Ala Glu
 405 410 415

Phe Trp Ala Arg Glu Ile Ser Leu Phe Arg Arg Thr Ile Pro Val Asp
 420 425 430

Gly Leu Trp Ile Asp Met Asn Glu Ile Ser Asn Phe Tyr Asn Pro Glu
 435 440 445

Pro Met Asn Ala Leu Asp Asp Pro Pro Tyr Arg Ile Asn Asn Asp Gly
 450 455 460

Thr Gly Arg Pro Ile Asn Asn Lys Thr Val Arg Pro Leu Ala Val His
 465 470 475 480

Tyr Gly Gly Val Thr Glu Tyr Glu Glu His Asn Leu Phe Gly Leu Leu
 485 490 495

Q1 Glu Ala Arg Ala Thr Gly Arg Gly Val Leu Arg Asp Thr Gly Arg Arg
 500 505 510

Pro Phe Val Leu Ser Arg Ser Thr Phe Val Gly Ser Gly Arg Tyr Thr
 515 520 525

Ala Tyr Trp Thr Gly Asp Asn Ala Ala Thr Trp Gly Asp Leu Arg Tyr
 530 535 540

Ser Ile Asn Thr Met Leu Ser Phe Gly Leu Phe Gly Met Pro Met Ile
 545 550 555 560

Gly Ala Asp Ile Cys Gly Phe Asn Gly Asn Thr Thr Glu Glu Leu Cys
 565 570 575

Gly Arg Trp Ile Gln Leu Gly Ala Phe Tyr Pro Phe Ser Arg Asp His
 580 585 590

Ser Ala Ile Phe Thr Val Arg Arg Glu Leu Tyr Leu Trp Pro Ser Val
 595 600 605

Ala Ala Ser Gly Arg Lys Ala Leu Gly Leu Arg Tyr Gln Leu Leu Pro
 610 615 620

Tyr Phe Tyr Thr Leu Met Tyr Glu Ala His Met Thr Gly Ala Pro Ile

625

630

635

640

Ala Arg Pro Leu Phe Phe Ser Tyr Pro His Asp Val Ala Thr Tyr Gly
645 650 655

Val Asp Arg Gln Phe Leu Leu Gly Arg Gly Val Leu Val Ser Pro Val
660 665 670

Leu Glu Pro Gly Pro Thr Thr Val Asp Ala Tyr Phe Pro Ala Gly Arg
675 680 685

Trp Tyr Arg Leu Tyr Asp Tyr Ser Leu Ala Val Ala Thr Arg Thr Gly
690 695 700

Lys His Val Arg Leu Pro Ala Pro Ala Asp Thr Val Asn Val His Leu
705 710 715 720

Thr Gly Gly Thr Ile Leu Pro Leu Gln Gln Ser Ala Leu Thr Thr Ser
725 730 735

Arg Ala Arg Arg Thr Ala Phe His Leu Leu Val Ala Leu Ala Glu Asp
740 745 750

Gly Thr Ala Ser Gly Tyr Leu Phe Leu Asp Asp Gly Asp Ser Pro Glu
755 760 765

Tyr Gly Arg Arg Ser Asp Trp Ser Met Val Arg Phe Asn Tyr Lys Ile
770 775 780

Pro Asn Asn Lys Gly Ala Ile Lys Val Lys Ser Glu Val Val His Asn
785 790 795 800

Ser Tyr Ala Gln Ser Arg Thr Leu Val Ile Ser Lys Val Val Leu Met
805 810 815

Gly His Arg Ser Pro Ala Ala Pro Lys Lys Leu Thr Val His Val Asn
820 825 830

Ser Ala Glu Val Glu Ala Ser Ser Ser Ala Gly Thr Arg Tyr Gln Asn
835 840 845

Ala Gly Gly Leu Gly Gly Val Ala His Ile Gly Gly Leu Ser Leu Val
850 855 860

Val Gly Glu Glu Phe Glu Leu Lys Val Ala Met Ser Tyr
865 870 875

<210> 2
<211> 914
<212> PRT
<213> Sugar beet

<400> 2

Met	Glu	Arg	Ser	Lys	Leu	Pro	Arg	Tyr	Ile	Cys	Pro	Thr	Leu	Ala	Val	
1				5					10					15		
Val	Leu	Pro	Leu	Val	Leu	Cys	Met	Val	Val	Glu	Gly	Ala	Thr	Thr	Ser	
	20					25						30				
Lys	Asn	Asp	Asn	Gln	Gly	Glu	Ala	Ile	Gly	Tyr	Gly	Tyr	Gln	Val	Lys	
	35					40						45				
Asn	Ala	Lys	Val	Asp	Asn	Ser	Thr	Gly	Lys	Ser	Leu	Thr	Ala	Leu	Leu	
	50					55					60					
Gln	Leu	Ile	Arg	Asn	Ser	Pro	Val	Tyr	Gly	Pro	Asp	Ile	His	Phe	Leu	
	65					70				75			80			
Ser	Phe	Thr	Ala	Ser	Phe	Glu	Glu	Asp	Asp	Thr	Leu	Arg	Ile	Arg	Phe	
	85						90					95				
(a)	Thr	Asp	Ala	Asn	Asn	Arg	Arg	Trp	Glu	Ile	Pro	Asn	Glu	Val	Leu	Pro
									105				110			
Arg	Pro	Pro	Pro	Pro	Ser	Pro	Pro	Pro	Leu	Ser	Ser	Leu	Gln	His		
	115						120				125					
Leu	Pro	Lys	Pro	Ile	Pro	Gln	Asn	Gln	Pro	Thr	Thr	Thr	Val	Leu	Ser	
	130					135				140						
His	Pro	His	Ser	Asp	Leu	Ala	Phe	Thr	Leu	Phe	His	Thr	Thr	Pro	Phe	
	145					150				155			160			
Gly	Phe	Thr	Ile	Tyr	Arg	Lys	Ser	Thr	His	Asp	Val	Leu	Phe	Asp	Ala	
	165						170					175				
Thr	Pro	Ile	Pro	Ser	Asn	Pro	Thr	Thr	Phe	Leu	Ile	Tyr	Lys	Asp	Gln	
							180		185			190				
Tyr	Leu	Gln	Leu	Ser	Ser	Ser	Leu	Pro	Ala	Gln	Gln	Ala	His	Leu	Tyr	
	195						200				205					
Gly	Leu	Gly	Glu	His	Thr	Lys	Pro	Thr	Phe	Gln	Leu	Ala	His	Asn	Gln	
	210					215				220						

Ile Leu Thr Leu Trp Asn Ala Asp Ile Ala Ser Phe Asn Arg Asp Leu
225 230 235 240

Asn Leu Tyr Gly Ser His Pro Phe Tyr Met Asp Val Arg Ser Ser Pro
245 250 255

Met Val Gly Ser Thr His Gly Val Phe Leu Leu Asn Ser Asn Gly Met
260 265 270

Asp Val Glu Tyr Thr Gly Asp Arg Ile Thr Tyr Lys Val Ile Gly Gly
275 280 285

Ile Ile Asp Leu Tyr Ile Phe Ala Gly Arg Thr Pro Glu Met Val Leu
290 295 300

Asp Gln Tyr Thr Lys Leu Ile Gly Arg Pro Ala Pro Met Pro Tyr Trp
305 310 315 320

Ala Phe Gly Phe His Gln Cys Arg Trp Gly Tyr Arg Asp Val Asn Glu
325 330 335

Ile Glu Thr Val Val Asp Lys Tyr Ala Glu Ala Arg Ile Pro Leu Glu
340 345 350

Val Met Trp Thr Asp Ile Asp Tyr Met Asp Ala Phe Lys Asp Phe Thr
355 360 365

A Leu Asp Pro Val His Phe Pro Leu Asp Lys Met Gln Gln Phe Val Thr
370 375 380

Lys Leu His Arg Asn Gly Gln Arg Tyr Val Pro Ile Leu Asp Pro Gly
385 390 395 400

Ile Asn Thr Asn Lys Ser Tyr Gly Thr Phe Ile Arg Gly Met Gln Ser
405 410 415

Asn Val Phe Ile Lys Arg Asn Gly Asn Pro Tyr Leu Gly Ser Val Trp
420 425 430

Pro Gly Pro Val Tyr Tyr Pro Asp Phe Leu Asp Pro Ala Ala Arg Ser
435 440 445

Phe Trp Val Asp Glu Ile Lys Arg Phe Arg Asp Ile Leu Pro Ile Asp
450 455 460

Gly Ile Trp Ile Asp Met Asn Glu Ala Ser Asn Phe Ile Thr Ser Ala
465 470 475 480

Pro Thr Pro Gly Ser Thr Leu Asp Asn Pro Pro Tyr Lys Ile Asn Asn
485 490 495

Ser Gly Gly Arg Val Pro Ile Asn Ser Lys Thr Ile Pro Ala Thr Ala
500 505 510

Met His Tyr Gly Asn Val Thr Glu Tyr Asn Ala His Asn Leu Tyr Gly
515 520 525

Phe Leu Glu Ser Gln Ala Thr Arg Glu Ala Leu Val Arg Pro Ala Thr
530 535 540

Arg Gly Pro Phe Leu Leu Ser Arg Ser Thr Phe Ala Gly Ser Gly Lys
545 550 555 560

Tyr Thr Ala His Trp Thr Gly Asp Asn Ala Ala Arg Trp Asp Asp Leu
565 570 575

Gln Tyr Ser Ile Pro Thr Met Leu Asn Phe Gly Leu Phe Gly Met Pro
580 585 590

Met Ile Gly Ala Asp Ile Cys Gly Phe Ala Glu Ser Thr Thr Glu Glu
595 600 605

Leu Cys Cys Arg Trp Ile Gln Leu Gly Ala Phe Tyr Pro Phe Ser Arg
610 615 620

Asp His Ser Ala Arg Asp Thr Thr His Gln Glu Leu Tyr Leu Trp Glu
625 630 635 640

Ser Val Ala Ala Ser Ala Arg Thr Val Leu Gly Leu Arg Tyr Glu Leu
645 650 655

Leu Pro Tyr Tyr Tyr Thr Leu Met Tyr Asp Ala Asn Leu Arg Gly Ser
660 665 670

Pro Ile Ala Arg Pro Leu Ser Phe Thr Phe Pro Asp Asp Val Ala Thr
675 680 685

Tyr Gly Ile Ser Ser Gln Phe Leu Ile Gly Arg Gly Ile Met Val Ser
690 695 700

Pro Val Leu Gln Pro Gly Ser Ser Ile Val Asn Ala Tyr Ser Pro Arg
705 710 715 720

Gly Asn Trp Val Ser Leu Ser Asn Tyr Thr Ser Ser Val Ser Val Ser
725 730 735

Ala Gly Thr Tyr Val Ser Leu Ser Ala Pro Pro Asp His Ile Asn Val
740 745 750

His Ile His Glu Gly Asn Ile Val Ala Met Gln Gly Glu Ala Met Thr
755 760 765

Thr Gln Ala Ala Arg Ser Thr Pro Phe His Leu Leu Val Val Met Ser
770 775 780

Asp His Val Ala Ser Thr Gly Glu Leu Phe Leu Asp Asn Gly Ile Glu
785 790 795 800

Met Asp Ile Gly Gly Pro Gly Lys Trp Thr Leu Val Arg Phe Phe
805 810 815

Ala Glu Ser Gly Ile Asn Asn Leu Thr Ile Ser Ser Glu Val Val Asn
820 825 830

Arg Gly Tyr Ala Met Ser Gln Arg Trp Val Met Asp Lys Ile Thr Ile
835 840 845

Leu Gly Leu Lys Arg Arg Val Lys Ile Lys Glu Tyr Thr Val Gln Lys
850 855 860

R1 Asp Ala Gly Ala Ile Lys Val Lys Gly Leu Gly Arg Arg Thr Ser Ser
865 870 875 880

His Asn Gln Gly Gly Phe Phe Val Ser Val Ile Ser Asp Leu Arg Gln
885 890 895

Leu Val Gly Gln Ala Phe Lys Leu Glu Leu Glu Phe Glu Gly Ala Thr
900 905 910

Arg Val

<210> 3

<211> 903

<212> PRT

<213> Spinach

<400> 3

Met Lys Lys Lys Ile Pro Ser Leu Ala Leu Gly Ile Leu Leu Val Phe
1 5 10 15

Leu Leu Gln Tyr Leu Val Ala Gly Ile Ser Thr Ser Glu Asn Asp Pro
20 25 30

Glu Gly Val Ile Gly Tyr Gly Tyr Lys Val Lys Ser Val Lys Val Asp
35 40 45

Ser Gly Thr Arg Arg Ser Leu Thr Ala Leu Pro Gln Leu Val Lys Asn
50 55 60

Ser Ser Val Tyr Gly Pro Asp Ile Gln Leu Leu Ser Ile Thr Ala Ser
65 70 75 80

Leu Glu Ser Asn Asp Arg Leu Arg Val Arg Ile Thr Asp Ala Lys His
85 90 95

Arg Arg Trp Glu Ile Pro Asp Asn Ile Leu His Arg His Gln Pro Pro
100 105 110

Pro Pro Pro His Ser Leu Ser Ser Leu Tyr Arg Thr Leu Leu Ser
115 120 125

Ser Pro Thr Thr Asn Arg Arg Lys Ile Leu Leu Ser His Pro Asn Ser
130 135 140

Asp Leu Thr Phe Ser Leu Ile Asn Thr Thr Pro Phe Gly Phe Thr Ile
145 150 155 160

Q1

Ser Arg Lys Ser Thr His Asp Val Leu Phe Asp Ala Thr Pro Asp Pro
165 170 175

Thr Asn Pro Asn Thr Phe Leu Ile Phe Ile Asp Gln Tyr Leu His Leu
180 185 190

Thr Ser Ser Leu Pro Gly Thr Arg Ala His Ile Tyr Gly Leu Gly Glu
195 200 205

His Ser Lys Pro Thr Phe Gln Leu Ala His Asn Gln Thr Leu Thr Met
210 215 220

Arg Ala Ala Asp Ile Pro Ser Ser Asn Pro Asp Val Asn Leu Tyr Gly
225 230 235 240

Ser His Pro Phe Tyr Met Asp Val Arg Ser Ser Pro Val Ala Gly Ser
245 250 255

Thr His Gly Val Leu Leu Leu Asn Ser Asn Gly Met Asp Val Glu Tyr
260 265 270

Thr Gly Asn Arg Ile Thr Tyr Lys Val Ile Gly Gly Ile Ile Asp Leu
275 280 285

Tyr Phe Phe Ala Gly Pro Ser Pro Gly Gln Val Val Glu Gln Phe Thr
290 295 300

Arg Val Ile Gly Arg Pro Ala Pro Met Pro Tyr Trp Ala Phe Gly Phe
305 310 315 320

Gln Gln Cys Arg Tyr Gly Tyr His Asp Val Tyr Glu Leu Gln Ser Val
325 330 335

Val Ala Gly Tyr Ala Lys Ala Lys Ile Pro Leu Glu Val Met Trp Thr
340 345 350

Asp Ile Asp Tyr Met Asp Ala Tyr Lys Asp Phe Thr Leu Asp Pro Val
355 360 365

Asn Phe Pro Leu Asp Lys Met Lys Lys Phe Val Asn Asn Leu His Lys
370 375 380

Asn Gly Gln Lys Tyr Val Val Ile Leu Asp Pro Gly Ile Ser Thr Asn
385 390 395 400

Lys Thr Tyr Glu Thr Tyr Ile Arg Gly Met Lys His Asp Val Phe Leu
405 410 415

β1

Lys Arg Asn Gly Lys Pro Tyr Leu Gly Ser Val Trp Pro Gly Pro Val
420 425 430

Tyr Phe Pro Asp Phe Leu Lys Pro Ser Ala Leu Thr Phe Trp Thr Asp
435 440 445

Glu Ile Lys Arg Phe Leu Asn Leu Leu Pro Val Asp Gly Leu Trp Ile
450 455 460

Asp Met Asn Glu Ile Ser Asn Phe Ile Ser Ser Pro Pro Ile Pro Gly
465 470 475 480

Ser Thr Leu Asp Asn Pro Pro Tyr Lys Ile Asn Asn Ser Gly Val Met
485 490 495

Leu Pro Ile Ile Asn Lys Thr Ile Pro Pro Thr Ala Met His Tyr Gly
500 505 510

Asp Ile Pro Glu Tyr Asn Val His Asn Leu Phe Gly Tyr Leu Glu Ala
515 520 525

Arg Val Thr Arg Ala Ala Leu Ile Lys Leu Thr Glu Lys Arg Pro Phe
530 535 540

Val Leu Ser Arg Ser Thr Phe Ser Gly Ser Gly Lys Tyr Thr Ala His
545 550 555 560

Trp Thr Gly Asp Asn Ala Ala Thr Trp Asn Asp Leu Val Tyr Ser Ile
565 570 575

Pro Ser Met Leu Asp Phe Gly Leu Phe Gly Ile Pro Met Val Gly Ala
580 585 590

Asp Ile Cys Gly Phe Leu Gly Asn Thr Thr Glu Glu Leu Cys Arg Arg
595 600 605

Trp Ile Gln Leu Gly Ala Phe Tyr Pro Phe Ser Arg Asp His Ser Ser
610 615 620

Leu Gly Thr Thr Tyr Gln Glu Leu Tyr Arg Trp Glu Ser Val Ala Ala
625 630 635 640

Ser Ala Arg Lys Val Leu Gly Leu Arg Tyr Thr Leu Leu Pro Tyr Phe
645 650 655

Tyr Thr Leu Met Tyr Glu Ala Gln Leu Asn Gly Ile Pro Ile Ala Arg
660 665 670

Pro Leu Phe Phe Ser Phe Pro Asp Asp Ile Lys Thr Tyr Gly Ile Ser
675 680 685

Ser Gln Phe Leu Leu Gly Lys Gly Val Met Val Ser Pro Val Leu Lys
690 695 700

Pro Gly Val Val Ser Val Thr Ala Tyr Phe Pro Arg Gly Asn Trp Phe
705 710 715 720

Asp Leu Phe Asp Tyr Thr Arg Ser Val Thr Ala Ser Thr Gly Arg Tyr
725 730 735

Val Thr Leu Ser Ala Pro Pro Asp His Ile Asn Val His Ile Gln Glu
740 745 750

Gly Asn Ile Leu Ala Met Gln Gly Lys Ala Met Thr Thr Gln Ala Ala
755 760 765

Arg Lys Thr Pro Phe His Leu Leu Val Val Met Ser Asp Cys Gly Ala
770 775 780

Ser Phe Gly Glu Leu Phe Leu Asp Asp Gly Val Glu Val Thr Met Gly
785 790 795 800

Val Asn Arg Gly Lys Trp Thr Phe Val Lys Phe Ile Ala Ala Ser Ala
805 810 815

Lys Gln Thr Cys Ile Ile Thr Ser Asp Val Val Ser Gly Glu Phe Ala
820 825 830

Val Ser Gln Lys Trp Val Ile Asp Lys Val Thr Ile Leu Gly Leu Arg
835 840 845

Lys Gly Thr Lys Ile Asn Gly Tyr Thr Val Arg Thr Gly Ala Val Thr
850 855 860

Arg Lys Gly Asp Lys Ser Lys Leu Lys Ser Thr Pro Asp Arg Lys Gly
865 870 875 880

Glu Phe Ile Val Ala Glu Ile Ser Gly Leu Asn Leu Leu Leu Gly Arg
885 890 895

Glu Phe Lys Leu Val Leu His
900

a1

<210> 4
<211> 902
<212> PRT
<213> Arabidopsis

<400> 4

Met Ser Ser Leu His Trp Phe Pro Asn Ile Phe Ile Val Val Val
1 5 10 15

Phe Phe Ser Leu Arg Ser Ser Gln Val Val Leu Glu Glu Glu Ser
20 25 30

Thr Val Val Gly Tyr Gly Tyr Val Val Arg Ser Val Gly Val Asp Ser
35 40 45

Asn Arg Gln Val Leu Thr Ala Lys Leu Asp Leu Ile Lys Pro Ser Ser
50 55 60

Val Tyr Ala Pro Asp Ile Lys Ser Leu Asn Leu His Val Ser Leu Glu
65 70 75 80

Thr Ser Glu Arg Leu Arg Ile Arg Ile Thr Asp Ser Ser Gln Gln Arg
85 90 95

Trp Glu Ile Pro Glu Thr Val Ile Pro Arg Ala Gly Asn His Ser Pro

100 105 110

Arg Arg Phe Ser Thr Glu Glu Asp Gly Gly Asn Ser Pro Glu Asn Asn
115 120 125

Phe Leu Ala Asp Pro Ser Ser Asp Leu Val Phe Thr Leu His Asn Thr
130 135 140

Thr Pro Phe Gly Phe Ser Val Ser Arg Arg Ser Ser Gly Asp Ile Leu
145 150 155 160

Phe Asp Thr Ser Pro Asp Ser Ser Asp Ser Asn Thr Tyr Phe Ile Phe
165 170 175

Lys Asp Gln Phe Leu Gln Leu Ser Ser Ala Leu Pro Glu Asn Arg Ser
180 185 190

Asn Leu Tyr Gly Ile Gly Glu His Thr Lys Arg Ser Phe Arg Leu Ile
195 200 205

Pro Gly Glu Thr Met Thr Leu Trp Asn Ala Asp Ile Gly Ser Glu Asn
210 215 220

Q1

Pro Asp Val Asn Leu Tyr Gly Ser His Pro Phe Tyr Met Asp Val Arg
225 230 235 240

Gly Ser Lys Gly Asn Glu Glu Ala Gly Thr Thr His Gly Val Leu Leu
245 250 255

Leu Asn Ser Asn Gly Met Asp Val Lys Tyr Glu Gly His Arg Ile Thr
260 265 270

Tyr Asn Val Ile Gly Gly Val Ile Asp Leu Tyr Val Phe Ala Gly Pro
275 280 285

Ser Pro Glu Met Val Met Asn Gln Tyr Thr Glu Leu Ile Gly Arg Pro
290 295 300

Ala Pro Met Pro Tyr Trp Ser Phe Gly Phe His Gln Cys Arg Tyr Gly
305 310 315 320

Tyr Lys Asn Val Ser Asp Leu Glu Tyr Val Val Asp Gly Tyr Ala Lys
325 330 335

Ala Gly Ile Pro Leu Glu Val Met Trp Thr Asp Ile Asp Tyr Met Asp
340 345 350

Gly Tyr Lys Asp Phe Thr Leu Asp Pro Val Asn Phe Pro Glu Asp Lys

355

360

365

Met Gln Ser Phe Val Asp Thr Leu His Lys Asn Gly Gln Lys Tyr Val
 370 375 380

Leu Ile Leu Asp Pro Gly Ile Gly Val Asp Ser Ser Tyr Gly Thr Tyr
 385 390 395 400

Asn Arg Gly Met Glu Ala Asp Val Phe Ile Lys Arg Asn Gly Glu Pro
 405 410 415

Tyr Leu Gly Glu Val Trp Pro Gly Lys Val Tyr Phe Pro Asp Phe Leu
 420 425 430

Asn Pro Ala Ala Ala Thr Phe Trp Ser Asn Glu Ile Lys Met Phe Gln
 435 440 445

Glu Ile Leu Pro Leu Asp Gly Leu Trp Ile Asp Met Asn Glu Leu Ser
 450 455 460

Asn Phe Ile Thr Ser Pro Leu Ser Ser Gly Ser Ser Leu Asp Asp Pro
 465 470 475 480

Ay Pro Tyr Lys Ile Asn Asn Ser Gly Asp Lys Arg Pro Ile Asn Asn Lys
 485 490 495

Thr Val Pro Ala Thr Ser Ile His Phe Gly Asn Ile Ser Glu Tyr Asp
 500 505 510

Ala His Asn Leu Tyr Gly Leu Leu Glu Ala Lys Ala Thr His Gln Ala
 515 520 525

Val Val Asp Ile Thr Gly Lys Arg Pro Phe Ile Leu Ser Arg Ser Thr
 530 535 540

Phe Val Ser Ser Gly Lys Tyr Thr Ala His Trp Thr Gly Asp Asn Ala
 545 550 555 560

Ala Lys Trp Glu Asp Leu Ala Tyr Ser Ile Pro Gly Ile Leu Asn Phe
 565 570 575

Gly Leu Phe Gly Ile Pro Met Val Gly Ala Asp Ile Cys Gly Phe Ser
 580 585 590

His Asp Thr Thr Glu Glu Leu Cys Arg Arg Trp Ile Gln Leu Gly Ala
 595 600 605

Phe Tyr Pro Phe Ala Arg Asp His Ser Ser Leu Gly Thr Ala Arg Gln

610

615

620

Glu Leu Tyr Leu Trp Asp Ser Val Ala Ser Ser Ala Arg Lys Val Leu
625 630 635 640

Gly Leu Arg Met Arg Leu Leu Pro His Leu Tyr Thr Leu Met Tyr Glu
645 650 655

Ala His Val Ser Gly Asn Pro Ile Ala Arg Pro Leu Phe Phe Ser Phe
660 665 670

Pro Gln Asp Thr Lys Thr Tyr Glu Ile Asp Ser Gln Phe Leu Ile Gly
675 680 685

Lys Ser Ile Met Val Ser Pro Ala Leu Lys Gln Gly Ala Val Ala Val
690 695 700

Asp Ala Tyr Phe Pro Ala Gly Asn Trp Phe Asp Leu Phe Asn Tyr Ser
705 710 715 720

Phe Ala Val Gly Gly Asp Ser Gly Lys His Val Arg Leu Asp Thr Pro
725 730 735

Ala Asp His Val Asn Val His Val Arg Glu Gly Ser Ile Val Ala Met
740 745 750

R\ Gln Gly Glu Ala Leu Thr Thr Arg Asp Ala Arg Lys Thr Pro Tyr Gln
755 760 765

Leu Leu Val Val Ala Ser Arg Leu Glu Asn Ile Ser Gly Glu Leu Phe
770 775 780

Leu Asp Asp Gly Glu Asn Leu Arg Met Gly Ala Gly Gly Asn Arg
785 790 795 800

Asp Trp Thr Leu Val Lys Phe Arg Cys Tyr Val Thr Gly Lys Ser Val
805 810 815

Val Leu Arg Ser Glu Val Val Asn Pro Glu Tyr Ala Ser Lys Met Lys
820 825 830

Trp Ser Ile Gly Lys Val Thr Phe Val Gly Phe Glu Asn Val Glu Asn
835 840 845

Val Lys Thr Tyr Glu Val Arg Thr Ser Glu Arg Leu Arg Ser Pro Arg
850 855 860

Ile Ser Leu Ile Lys Thr Val Ser Asp Asn Asp Asp Pro Arg Phe Leu

865

870

875

880

Ser Val Glu Val Ser Lys Leu Ser Leu Leu Val Gly Lys Lys Phe Glu
885 890 895

Met Arg Leu Arg Leu Thr
900

<210> 5
<211> 29
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:synthetic
oligonucleotide

<400> 5
cggtaagtt gacaggatcc aaggtgaag

29

Al

<210> 6
<211> 30
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:synthetic
oligonucleotide

<400> 6
gagctcgccg gcgggaaat ttacacggtc

30

<210> 7
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:synthetic
oligonucleotide

<400> 7
ccaggagggtg gaacggggtc cggcgc

26